

CLAIMS

Having thus described the preferred embodiments, the invention is now claimed to be:

1. A radio frequency coil system (38) for magnetic resonance imaging, the coil system (38) comprising:
 - a plurality of parallel spaced apart rungs (60) which each includes rung capacitors (68);
 - an end cap (64) disposed at a closed end (66) of the coil system (38); and
 - an RF shield (62) which is connected to the end cap (64) and surrounds the rungs (60) extending in a direction substantially parallel to rungs (60).
2. The coil system as set forth in claim 1, wherein the RF shield (62) is partially or wholly constructed of electrically conductive mesh or other conductive material with properties of at least partial optical transparency in a wavelength range of human vision.
3. The coil system as set forth in claim 1, further including:
 - an end ring (78) disposed at an closed end (66) of the coil system (38) and being coupled to the rungs (60), the end ring having capacitors (80) between neighboring rungs.
4. The coil system as set forth in 3, wherein the rungs (60) are directly connected to the RF shield (62) at an open end (72).
5. The coil system as set forth in claim 1, further including:
 - an end ring (70) disposed at an open end (72) of the coil system (38) and being coupled to the rungs (60), the end ring having capacitors (74) between neighboring rungs.
6. The coil system as set forth in claim 5, wherein each pair of neighboring rungs (60) is further coupled through closed end capacitors (80) to define individual independent current loops or meshes.

7. The coil system as set forth in claim 6, wherein the capacitors (68, 74) are selected to decouple the current loops or meshes to define a transmit/receive coil array forming a plurality of individual transmit/receive channels, such that each loop has selected phase and amplitude characteristics.

8. The coil system as set forth in claim 5, wherein at least one of the end ring (70) and the rungs (60) are capacitively coupled to the RF screen adjacent the open end via capacitors (92) to define a current path through the RF screen (62).

9. The coil system as set forth in claim 8, wherein the coil system (38) is a transmit/receive coil and a volume coil.

10. The coil system as set forth in claim 9, further including:
inductors (100) connected between at least one of the end ring (70) and the rungs (60) to define a third resonance mode.

11. The coil system as set forth in claim 5, wherein the rung and end ring capacitors (68, 74) are selected to tune the coil system (38) to a resonance frequency in one of:

a low-pass mode,
a high-pass mode, and
a bandpass mode.

12. The coil system as set forth in claim 1, wherein the rungs (60) are directly connected to the end cap (64).

13. The coil system as set forth in claim 1, wherein the rungs (60) are capacitively coupled to the RF screen (62).

14. The coil system as set forth in claim 1, wherein pairs of the rungs (60) are coupled by open end capacitors (74) to define individual meshes (82) and further including:

couplings (86) coupled to adjacent meshes (82), the couplings including one of:

capacitive decouplings,

inductive decouplings,

impedance transformers (88), and

overlapping portions of the individual meshes (82).

15. The coil system as set forth in claim 14, wherein the coil system (38) is tuned by the rung capacitors (68), the open end capacitors (74), and the couplings (86) to one of a volume mode and a SENSE mode.

16. The coil system as set forth in claim 15, wherein the couplings (86) include switching components for selectively switching between the volume mode and the SENSE mode.

17. The coil system as set forth in claim 16, wherein each rung (60) is directly connected to the end cap (64) and each mesh (82) includes the end ring capacitor (74) disposed at an open end (72) of the coil system (38).

18. The coil system as set forth in claim 17, wherein each pair of the rungs (60) of each mesh (82) is further coupled by a closed end capacitor (80) to define individual independent current loops.

19. A method of using the coil system (38) of claim 1 comprising:
coupling an end ring to an open end of the coil system, the end ring having open end capacitors (74) between neighboring rungs to define a bandpass mode.

20. The method as set forth in claim 19, further including:

coupling each pair of neighboring rungs through closed end capacitors (80) to define individual independent current loops; and

proportioning the strip and open end capacitors (68, 74) to decouple the current loops to define a transmit/receive coil array.

21. The method as set forth in claim 19, further including:

capacitively coupling at least one of the end ring and the rungs to the RF screen adjacent the open end via capacitors (92) to define a current path through the RF screen; and

tuning the capacitors (92) to a high resonance frequency to define a dual resonance mode, wherein the coil system is a transmit/receive coil and a volume coil.

22. The method as set forth in claim 19, further including:

coupling pairs of the rungs by open end capacitors (74) to define individual meshes (82);

coupling adjacent meshes by one of:

capacitive couplings,

inductive couplings,

impedance transformers (88), and

overlapping portions of the individual meshes.

23. The method as set forth in claim 19, further including:

tuning the coil system (38) by the rung capacitors (68), the open end capacitors (74), and the couplings (86) to one of a volume mode and a SENSE mode.

24. A magnetic resonance imaging scanner (10) including:

a magnet (20) producing a main magnetic field;

a plurality of magnetic field gradient coils (30) arranged to produce magnetic field gradients to the main magnetic field; and

the radio frequency coil system (38) as set forth in claim 1, the rungs (60) extending in a direction substantially parallel to the main magnetic field.